

REMARKS/ARGUMENTS

Replacement sheets for Figures 17 and 18 including the legend "Prior Art" are submitted herewith in accordance with the requirement of the Examiner.

Claims 1-4 and 6-9 stand rejected under 35 U.S.C. §102(a) as being anticipated by Kagotani et al. This rejection is overcome by the Declaration under 37 C.F.R. §1.132 submitted herewith which states that the international filing date of August 11, 2004 for the present application is less than one year after the December 5, 2003 publication date of the Kagotani et al. reference. Accordingly, this rejection should be withdrawn by the Examiner.

Claims 6-8 stand rejected under 35 U.S.C. §102(b) as being anticipated by Masumoto '1978. It is requested that the Examiner reconsider and withdraw this rejection based on the arguments submitted hereinafter.

Claim 6 and dependent claims 7 and 8 all recite a lasing method which causes lasing by using a semiconductor quantum dot, comprising the step of forming a biexciton state in the semiconductor quantum dot by two-photon resonant excitation, so as to cause lasing by inducing light emission from the semiconductor quantum dot. This novel recitation is not anticipated or rendered obvious by the teachings of Masumoto '1978.

Masumoto '1978 discloses two-photon resonant excitation but is totally silent about the feature that the quantum dots are subjected to the two-photon resonant excitation, in contrast to the lasing method recited in claim 6-8. Accordingly, it is apparent that Masumoto '1978 fails to anticipate the novel recitations in claims 6-8.

Claims 1-4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Masumoto '1993 in view of Masumoto '1978. For the reasons submitted hereinafter, it is submitted that the

combined teachings of Masumoto '1993 and Masumoto '1978 clearly fail to render obvious or even suggest the novel recitations in claim 1 and dependent claims 2-4.

(1) Characteristic Features of Claim 1

The laser device recited in claim 1 has the following characteristic Features A and B.

Feature A: "a laser member in which said semiconductor quantum dot is formed".

Feature B: "an excitation light source section for irradiating the laser member with excitation light whose energy corresponds to two-photon resonant excitation".

The laser device recited in claim 1 can suppress, by applying Feature B to Feature A, an occurrence of a nonradiation process, which occurs in excitation of an exciton absorption band or in one-photon excitation of excitons, and therefore a larger number of biexcitons can contribute to the light emission (see paragraphs [0017], [0106], etc of the specification as originally filed). With the features of claim 1, it is possible to provide the laser device which utilizes an efficient light emitting phenomenon (see paragraphs [0018], [0107], etc. of the specification as originally filed).

(2) Comparison between Present Invention and Cited References

Masumoto '1993 discloses that a biexciton in a CuCl quantum dot is caused to emit a laser beam. Moreover, Masumoto '1978 discloses that a biexciton is formed by two-photon resonant excitation. However, Masumoto '1993 and Masumoto '1978 do not disclose at all that Feature B is applied to Feature A.

On the other hand, in claim 1 of the subject application, Feature B is applied to Feature A so that a larger number of biexcitons can contribute to the light emission. This makes it possible

to achieve lasing with drastically high energy efficiency (see paragraph [0082], etc. of the specification as originally filed), as compared to conventional techniques.

(3) Argument against Rejection under §103(a)

As mentioned above, application of Feature B to Feature A is not disclosed by the combined teachings of Masumoto '1978 and Masumoto '1993. Moreover, according to claim 1 of the subject application, which claims that Feature B is applied to Feature A, it is possible to provide the laser device which utilizes an efficient light emitting phenomenon (see paragraphs [0018], [0107], etc. of the specification as originally filed).

Specifically, the biexcitons are directly generated in the quantum dots by the two-photon resonant excitation, without the intermediary of the exciton state, and this allows easy formation of completely inverted population between biexciton and exciton states (see paragraphs [0020], [0049], [0109], etc. of the specification as originally filed). This makes it possible to cause superradiance, which is a special light emitting phenomenon as described in the third paragraph on page 3798 of the following enclosed publication: "Ultrafast emission under two-photon excitation of the biexcitons in CuCl quantum dots", phys. Stat. sol. (b)243, No. 14, 3795-3799 (2006). Consequently, light emitting efficiency can be drastically improved.

Such superradiance (i) attracts attention as a new mechanism of a high-speed device, and (ii) can be achieved by uniquely applying Feature B to Feature A.

Masumoto '1993 fails to disclose Feature B, and therefore it is impossible to directly generate biexcitons in quantum dots by two-photon resonant excitation, without the intermediary of an exciton state. Moreover, Masumoto '1978 fails to disclose Feature A, and accordingly completely inverted population cannot be formed between biexciton and exciton states.

Therefore, the features disclosed in Masumoto '1978 and Masumoto '1993 cannot cause superradiance, which can be achieved by the laser device recited in claim 1.

As described above, the laser device recited in claim 1 brings about the special effect of the superradiance, by Feature A and Feature B which are functionally related with each other. Moreover, even a person skilled in the art could not have naturally expected this special feature based on Masumoto '1978 and Masumoto '1993.

As described above, the application of Feature B to Feature A is not a known technique for a person skilled in the art. Moreover, the laser device recited in claim 1 brings about the advantageous effect which cannot be achieved based on Masumoto '1978 and Masumoto '1993.

Therefore, the laser device recited in claim 1 and dependent claims 2-4 is not obvious over Masumoto '1978 and Masumoto '1993.

Claim 5 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Masumoto '1993 and Masumoto '1978 as applied to claim 1, and further in view of Ledentsov N.N. et al.

Since claim 5 depends from claim 1, it is believed to be allowable over the teachings of Masumoto '1993 and Masumoto '1978 for the reasons submitted herein with respect to the rejection of claim 1. The reference to Ledentsov was cited by the Examiner for its limited teaching of InAs quantum dot and GaAs base material. Ledentsov fails to supply the deficiencies of Masumoto '1993 and Masumoto '1978 with respect to the novel recitations in claim 5 which depends from claim 1.

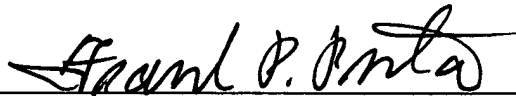
Claim 9 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Masumoto '1978. Since claim 9 depends from claim 7 which in turn depends from independent claim 6, it is submitted that claim 9 is allowable over the teaching of Masumoto '1978 for the reasons submitted herein with respect to the rejection of claims 6-8 under 35 U.S.C. §102(b).

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In view of the above amendments and remarks, it is submitted that claims 1-9 as currently amended are clearly allowable over the teachings of the cited references, and formal allowance thereof is earnestly solicited.

Respectfully submitted,

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